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Applicant:

Darrel L. Turner

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Art Unit: 3501

For:

HIGH HARDNESS BORON STEEL ROTARY BLADE

Examiner: T. MELIUS

DECLARATION OF DARREL L. TURNER

Darrel L. Turner, declares as follows:

1. Attached is a chart entitled "Comparison of Charpy V-Notch (CVN) Toughness for Blade Materials," representing averaged results of toughness tests on heat treated 5150, 1566 and 10B38 steel specimens at increasing levels of hardness.
2. The chart includes a line identified as "10B38 Expected" which includes averaged experimental data for yield strengths of 160 Ksi and below, and a hypothetical line showing projected decreasing toughness based on the experimental data for 5150 and 1566 steels as shown.
3. The line identified as "10B38 Experimental" shows actual averaged experimental results, indicating that in actual experimental results, the toughness of the heat treated 10B38 is higher than what would have been expected based on projections from the results of tests on conventional rotary blade materials.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

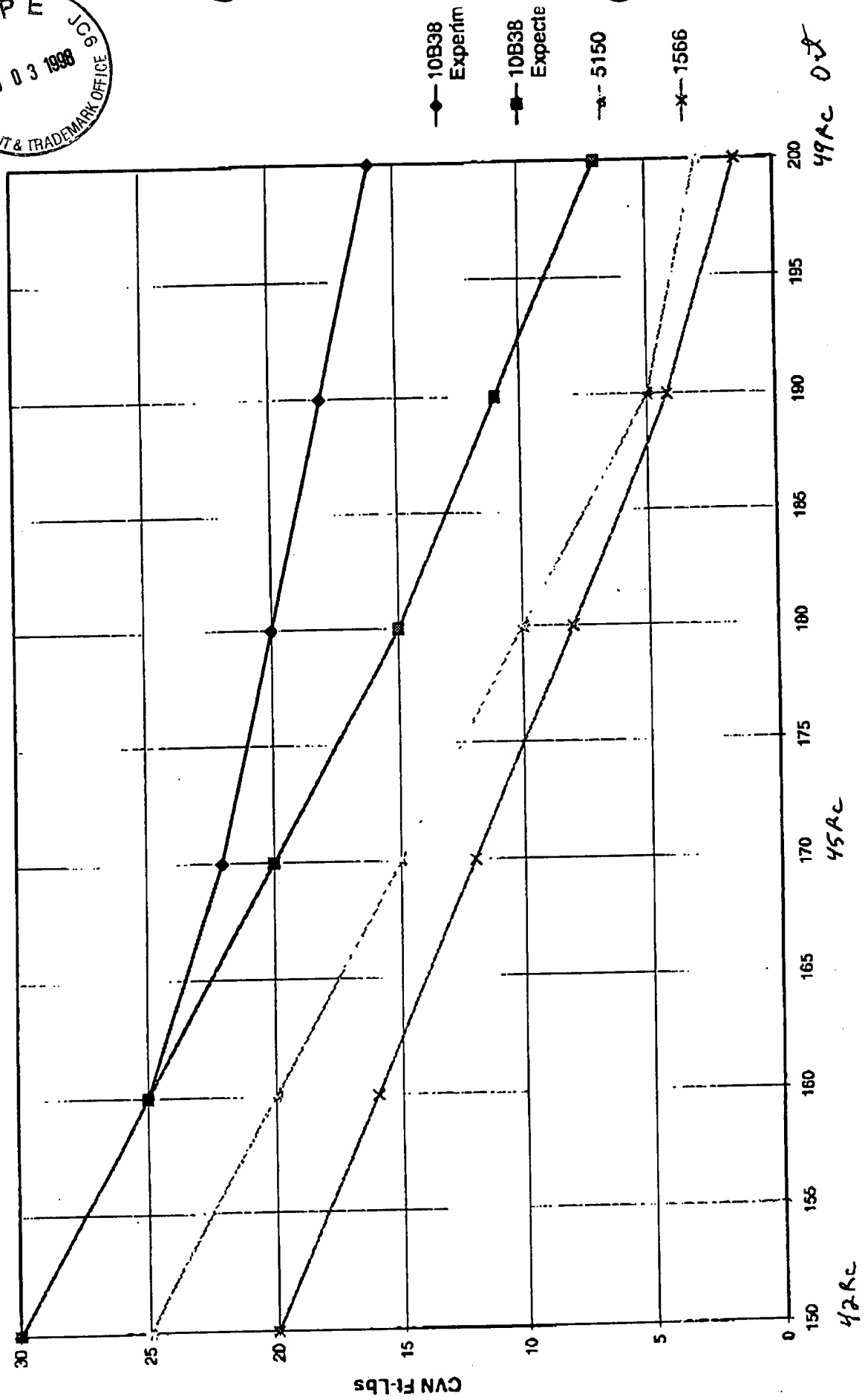
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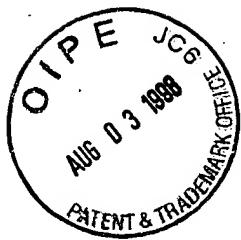


Comparison of Charpy V-Notch (CVN) Toughness for Blade Materials



Yield Strength KSI (1000 Lbs Per Square Inch)

HARDNESS (ROCKWELL C)



MANUAL^{on} Outdoor Power Equipment STANDARDS

Volume II



Outdoor Power Equipment Institute

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American Standard Safety Specifications for
Power Lawn Mowers

Sponsor

The Lawn Mower Institute, Inc

**SUPERSEDED BY AMERICAN NATIONAL STANDARD
B71.1-1980**

Approved June 23, 1960

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Foreword

(This Foreword is not a part of American Standard Safety Specifications for Power Lawn Mowers, B71.1-1960.)

On March 15, 1955, the American Standards Association Safety Standards Board, pursuant to a request from The Lawn Mower Institute, Incorporated, approved the initiation of a project, under the ASA Sectional Committee Method, for a safety standard on lawn mowers. The scope of the project was defined as:

Safety requirements for lawn mowers of reel- or rotary-blade type operated by hand power, internal combustion engines, or electric motors.

The Lawn Mower Institute was invited to sponsor the project.

The original incorporation of the Institute in March, 1952, as a nonprofit national trade association for lawn mower manufacturers was designed to promote both the welfare of the industry and public interest. A safety program was initiated at the industry's first annual convention in June, 1953. First efforts were devoted to user education and the publication of a safety code leaflet.

At the Institute's board meeting in May, 1954, it was suggested that the assistance of ASA be enlisted in the preparation of a lawn mower safety standard. The ASA called a preliminary conference of interested individuals and groups in New York City on February 1, 1955, which subsequently led to the project's authorization and approval. The first organizational meeting of the ASA sectional committee was held at ASA headquarters on February 10, 1956. The committee was formally designated as the ASA Sectional Committee on Safety Standards for Lawn Mowers, B71. Two subcommittees were authorized, one on engineering specifications and one on user education.

The ASA Sectional Committee on Safety Standards for Lawn Mowers, B71, had the following personnel when action was taken upon this standard:

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|---|-----------------------------|
| Organization Represented | Name of Representative |
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| Association of Casualty & Surety Companies | JOHN J. PASCAL |
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| U.S. Department of Agriculture | R. B. GRAY |
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The subcommittees of B71, which were directly responsible for the development of this standard, had the following personnel:

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American Standard Safety Specifications for Power Lawn Mowers

1. Scope

These specifications are for mowers designed primarily for sale to the general public, and not intended mainly for professional use.

2. Rotary Power Mowers

2.1 Definitions. For the purpose of these specifications, the following definitions are used to clarify the requirements:

2.1.1 "Shall." The word "shall" is to be understood as mandatory.

2.1.2 "Should." The word "should" is to be understood as advisory.

2.1.3 Angle of Exposure of the Blade

2.1.3.1 Vertical Angle of Exposure. (See Fig. 1.) This is the angle formed at a discharge opening between the horizontal planes and an unobstructed line from the outer tip of the blade-cutting edge, in a vertical plane tangent to the blade-tip circle, in the direction of rotation. In the case of multiblade mowers, the measurement is to be taken from the blade or blades nearest the discharge opening.

2.1.3.2 Net Vertical Angle of Exposure. (See Fig. 2.) This is the net difference between the maximum vertical angle in any plane and any portion of the angle that is blocked off by guards or other parts of the mower.

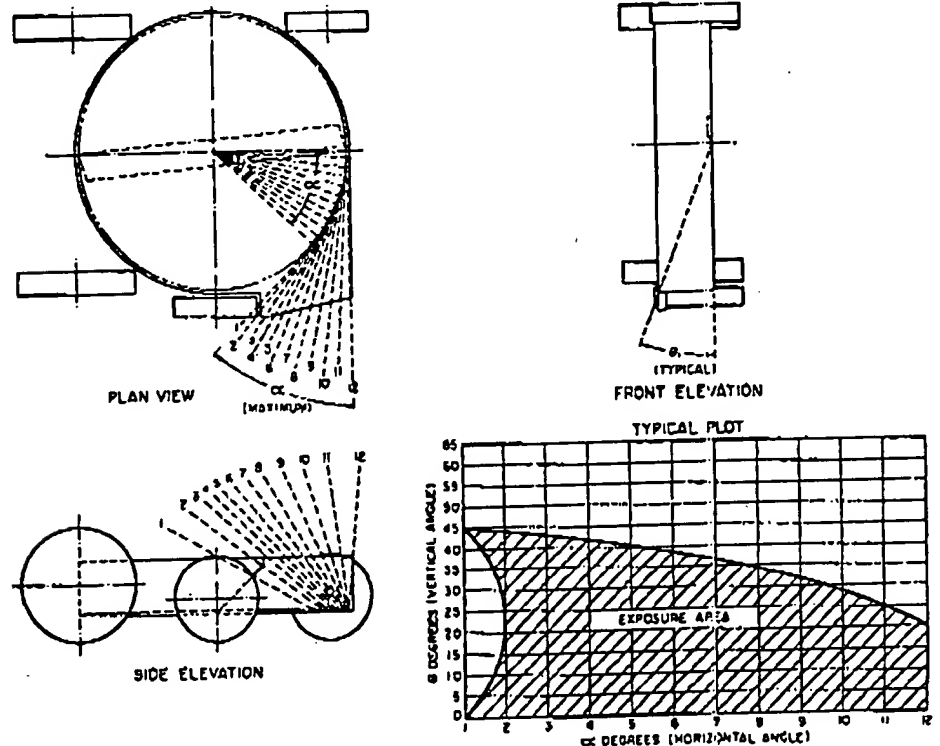


Fig. 1
Front Corner Discharge Chute
Single-Blade Mower

2.1.3.3 Average Net Vertical Angle of Exposure. This is the arithmetical average of the net vertical angle of exposure taken at 12 or more equally spaced points across the discharge opening.

2.1.3.4 Horizontal Angle of Exposure. (See Figs. 1 and 2.) This is the angle formed at a discharge opening between lines in a horizontal plane that are tangent to the blade-tip circle in the direction of rotation, and are unobstructed.

2.1.3.5 Equivalent Horizontal Angle of Exposure

2.1.3.5.1 Two-Blade Mower. (See Fig. 3.) The equivalent horizontal angle of exposure for a two-blade mower is the angle formed at the discharge opening between lines in a horizontal plane that extend, unobstructed, from the intersection point of the longitudinal center line of the blade enclosure and a line tangent to the front edges of the blade-tip circles.

2.1.3.5.2 Three-Blade Mower. (See Fig. 4.) The equivalent horizontal angle of exposure for a three-blade mower is the angle formed at the discharge opening between lines in a horizontal plane that extend, unobstructed, from the intersection point of the longitudinal center line of the blade enclosure and the front edge of the blade-tip circle of the center blade.

2.1.4 Swing-over Handle. A swing-over handle is one that is designed to swing from one end of the mower to the other, to allow reversing the direction of travel of the mower without turning the mower around.

2.2 Requirements

2.2.1 Blade Enclosure. The mower blade shall be enclosed.

2.2.2 Blade Exposure

2.2.2.1 Openings in the Blade Enclosure. Openings in the blade enclosure, for the discharge of grass

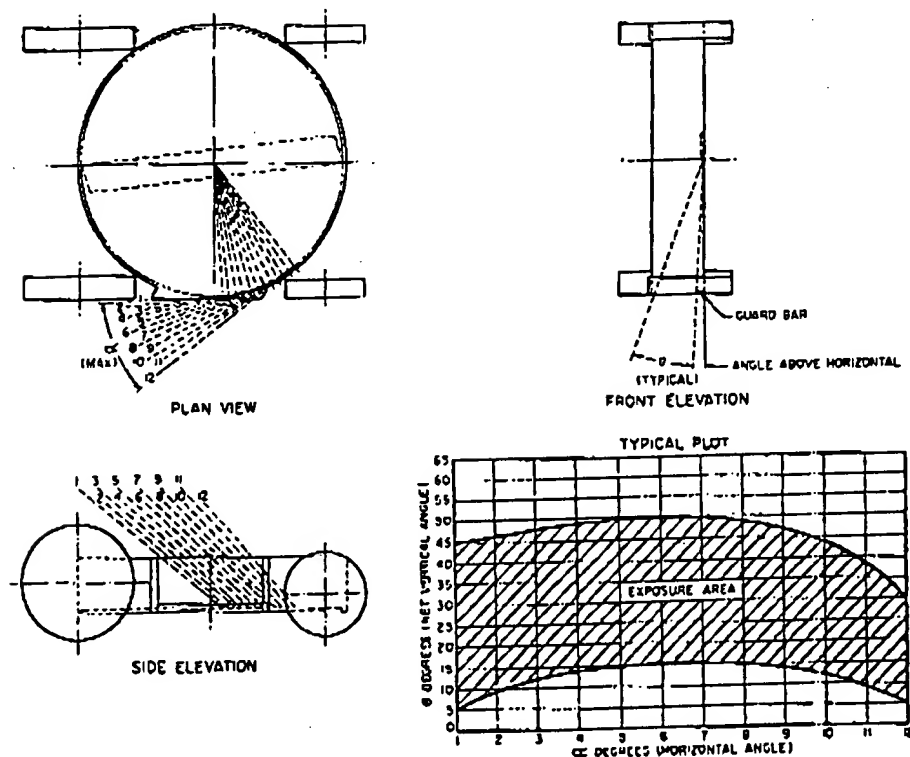


Fig. 2

Center Side Discharge Chute
Single-Blade Mower

or for other purposes, shall be limited as follows: Measurements shall be based on the position of the blade when it is operating at maximum governed speed. If the blade is adjustable, measurements shall be made when it is in its lowest cutting position.

- (1) Openings located within a 60-degree angle to the right or left of the front center line shall not allow more than a 30-degree net vertical angle of exposure of the blade.
- (2) Openings located beyond a 60-degree angle to the right or left of the front center line shall not allow more than a 35-degree net vertical angle of exposure of the blade.
- (3) The total exposure area of the opening or openings shall not exceed 1,000 square degrees. For a single-blade mower, the square degrees are to be the product of the total horizontal angle of exposure (see 2.1.3.4) times the average net vertical angle of exposure (see 2.1.3.3). For a multiple-blade mower, the equivalent horizontal angle of exposure (see 2.1.3.5) shall be used.

- (4) There shall either be a minimum unobstructed horizontal distance of three inches (for walk-behind mowers) or five inches (for riding mowers) from the end of the discharge chute to the tip of the blade, or there shall be a rigid bar across the discharge opening, secured to prevent removal. The bottom of the bar shall be no higher than the bottom of the blade enclosure, and the top of the bar shall be no lower than the highest point on the outer ends of the mower blade when operating at maximum governed speed.

2.2.2.3 Guarding of the Blade

2.2.2.2.1 Blade Position. At no time shall the blade extend below the sides or rear of the blade enclosure, except at the discharge opening or openings. At the front of the blade enclosure, except at a discharge opening or openings, the angle above the horizontal made by a line between the lowest point on the outer ends of the mower blade and the lower edge of the blade enclosure or front guard shall not exceed 15 degrees.

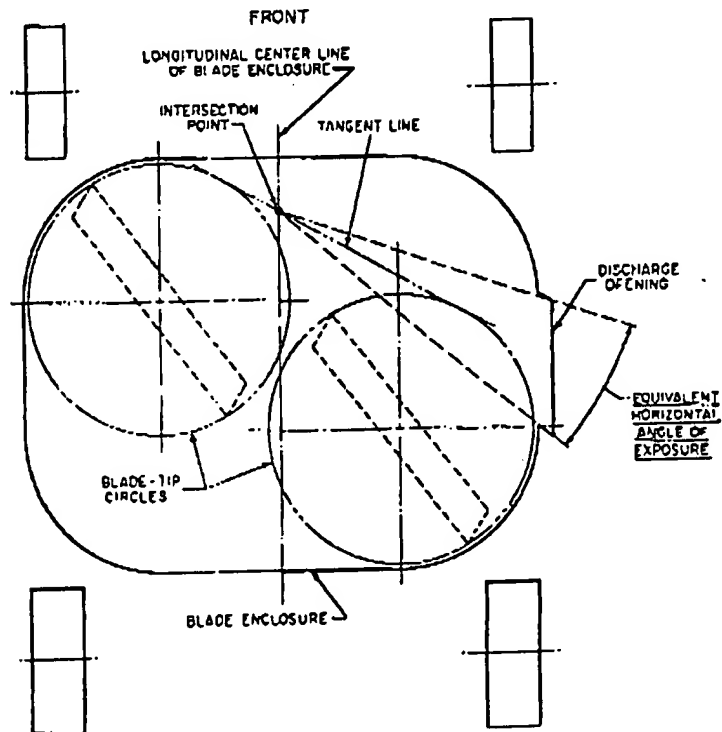


Fig. 3
Equivalent Horizontal Angle of Exposure
Two-Blade Mower

POWER LAWN MOWERS

2.2.2.2.3 Guards. Guards that are readily adjustable beyond the above limits, or readily removable, should not be used.

2.2.3 Warning Sign. The word "caution," or a stronger wording, easily legible from a standing position, shall be placed on the mower at or near each point of hazard.

2.2.4 Engine Safety Switch. The engine of the mower shall be equipped with a positive and reliable on-off ignition switch.

2.2.5 Blade and Blade Mounting

2.2.5.1 Steel Blade Material Requirements. The material in steel blades shall meet the following requirements:

- (1) The maximum hardness shall be Rockwell C value 48 at any point in the blade.
- (2) The maximum carbon content shall be 0.90 percent carbon.
- (3) Blades with more than 0.40 percent carbon, if heat treated, shall be austempered or hardened and drawn.

(4) The direction of the grain in the blade shall be parallel to the long axis of the blade.

(5) Should the material of the blades not satisfy the above requirements, it will still be considered satisfactory if the blades at their hardest points will withstand bending to a 45-degree angle on a radius equal to the thickness of the material.

(6) The blade material shall be of good quality and free of any visible imperfections which could cause weakness in the blade.

2.2.5.2 Multipiece Blade

2.2.5.2.1 Construction Requirement. The cutting members of a multipiece blade shall be positively affixed to the body of the blade or disk by substantial means other than brazing or welding.

2.2.5.2.2 Wear Test Requirement. In a multipiece blade the means of fastening the cutting members to the body of the blade or disk are very important. They shall be so designed that they will not become worn to a hazardous condition before the cutting members themselves are worn beyond prac-

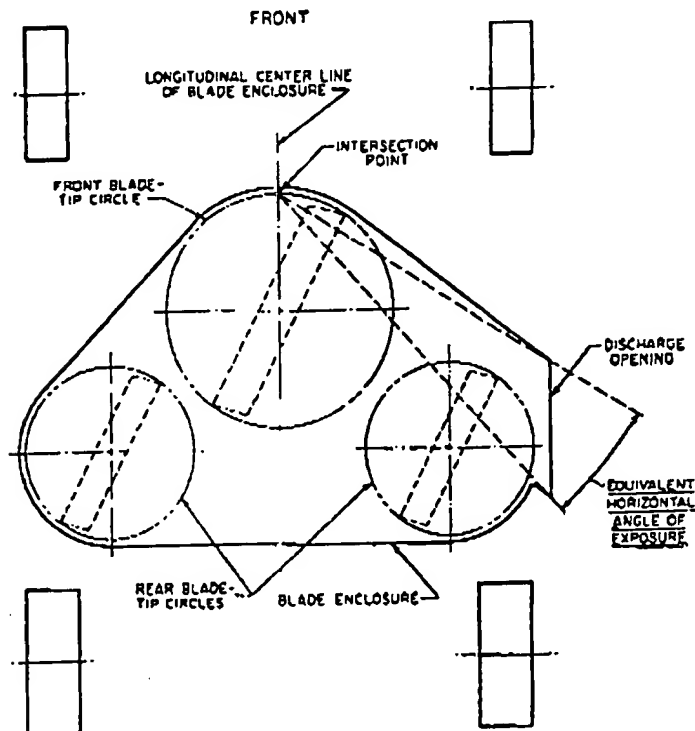


Fig. 4
Equivalent Horizontal Angle of Exposure
Three-Blade Mower

tical use. This should be tested by running the mower in a sandbox until the blades are worn out or until 100 hours are reached.

Note: The mower engine may be replaced by some other means for driving the blade at a speed equivalent to the maximum governed speed, if this will facilitate the test.

2.2.5.3 Strength Tests for Blade and Blade Mounting. The following destructive tests shall be conducted with the blade mounted on the complete mower and with the power plant operating at maximum governed speed. The cutting elements and attaching means, including blade, coupling, and fasteners, shall be designed, fabricated, and secured to the mower in such a manner that, under the destructive conditions of the tests, none of the component parts shall fracture, break, loosen, or deform in a manner hazardous to the operator or bystanders.

Note: If a mower is equipped with multipiece pivoted blades, and the blades are displaced from cutting position during the test, the test shall be interrupted and the blades repositioned before continuing the test. In the case of multiblade mowers, the tests shall be repeated with each blade.

2.2.5.3.1 Sudden Impact Test. The mower shall be tilted back on its wheels so that the front end of the mower can be dropped onto a $\frac{3}{4}$ -inch diameter steel rod 24 inches long which has been driven into firm ground until 4 inches of the rod extend above the ground. The mower shall be adjusted for a 2-inch height of cut or to the cutting height adjustment closest to 2 inches. The mower shall be dropped onto this rod in such a manner that the rotating blade will hit the exposed portion of the rod. This test shall be conducted at least once in each of the following ways, and, if the mower remains operative, repeated for a total of 3 times each way:

- (1) With the mower positioned so that contact between blade and rod is close to the blade hub or coupling.
- (2) With the mower positioned so that contact between blade and rod is close to the outer tip of the blade.

2.2.5.3.2 Repeated Impact Test. The mower, with the front skirt cut out if necessary, shall be moved into engagement with a solid disk of steel, measuring 6 inches in diameter by 2 inches high, which has been placed in such a position that the mower blade will make contact approximately in the center of the 2-inch dimension. The mower is to be pushed into engagement with the disk 25 times, the blade making positive contact each time.

2.2.5.3.3 Unbalance Test. A blade unbalance of 5 inch-ounces shall be created by removing or adding material at one end of the blade. The mower shall be run in this unbalanced condition at maximum governed speed for 1 hour.

2.2.5.3.4 Reverse Torque Test. Torque shall be applied to the mower blade (or, in the case of pivoted blades, to the blade support member), in the normal direction of rotation, and with the blade shaft locked against rotation, until the blade turns relative to the shaft, or until a torque of 50 foot-pounds is reached. If the blade turns relative to the shaft, it shall be rotated 15 times, or until the torque applied reaches 50 foot-pounds.

2.2.5.4 Blade-Rotation Warning. An audible or visible indication of blade rotation should be provided on electric mowers.

2.2.5.5 Blade Speed. The maximum tip speed of any blade shall not exceed 21,000 feet per minute.

2.2.5.6 Blade Throw-out Clutch. Mowers equipped with a blade throw-out clutch shall have a positive braking means to stop and prevent rotation of the blade when the blade drive is disengaged.

2.2.6 Mower Structure. The mower shall be designed, fabricated, and assembled in such a manner that, under the destructive conditions of the blade and blade-mounting strength tests, none of the component parts of the mower shall fracture, break, loosen, or deform in a manner which would make the mower hazardous to the operator or bystanders.

2.2.7 Mower Handle (Walk-behind Mowers Only)

2.2.7.1 Upstop. A positive automatic upstop or latch shall be provided for the mower handle on all mowers except electric ones. Swing-over handles (see 2.1.4) shall be allowed on the latter to reduce the electrical hazard of cutting the cord. The upstop or latch shall not allow the center of the handle grips to come closer than 17 inches, horizontally, behind the mower blade, unless manually disengaged. The upstop or latch shall automatically engage whenever the handle is placed in operating position, and shall not be subject to inadvertent disengagement during use of the mower.

2.2.7.2 Fastening. The mower handle shall be fastened to the mower so as to prevent inadvertent uncoupling while in the operating range, despite deformation of the handle or handle brackets during use of the mower.

2.2.8 Steering Handle (Riding Mowers Only). The steering handle shall be fastened to the mower so as to prevent inadvertent uncoupling, despite possible deformation of the handle or handle attaching means during use of the mower.

2.2.9 Wheel-Drive Controls (Walk-behind Mowers Only)

2.2.9.1 Safeguards. Wheel-drive controls shall provide positive disengagement and shall effectively prevent accidental engagement.

2.2.9.2 Direction of Operation. Wheel-drive controls, except "deadman" controls, should move back in order to stop forward motion. If reverse control is provided, it shall be of "deadman" type.

2.2.10 Wheel-Drive Controls (Riding Mowers Only)

2.2.10.1 Foot-Pedal Clutch Controls. Foot-pedal clutch controls, when provided, shall disengage the clutch automatically when foot pressure is removed, or other means shall be provided whereby the mower will stop if the operator removes his feet from the mower.

2.2.10.2 Hand-Lever Clutch Controls. Hand-lever clutch controls, when provided, shall move rearward in order to stop forward motion, or shall automatically disengage the clutch when hand pressure is removed.

2.2.10.3 Reverse-Drive Control. Reverse drive, when provided, shall be controlled as follows:

- (1) When the wheel drive is reversed by action of the foot-pedal or hand-lever clutch control, without a separate gearshift, the direction of motion of the control shall be opposite to that for forward motion. The control shall disengage the reverse drive automatically when pressure is released.
- (2) When a separate gearshift is provided to reverse the wheel drive, the direction of motion of the gearshift lever shall be to the rear for reverse, or the gearshift positions shall be clearly marked and visible to the operator.

2.2.11 Guarding of Chains, Belts, and Gears.

All moving chains, belts, and gears shall be enclosed or adequately guarded to prevent personal injury.

2.2.12 Safety Instructions. The mower manufacturer shall supply with the mower the Safety Guide issued by or available from The Lawn Mower Institute, or other safety instructions which are substantially equivalent.

2.2.13 Stability (Riding Mowers Only)

2.2.13.1 Lateral Stability. Lateral stability shall be tested with a 200-pound weight securely attached to the mower seat, with a center of gravity approximately 6 inches above the deepest point on the seat

surface. The mower shall not tip over when tilted 20 degrees from horizontal both to the left and to the right.

2.2.13.2 Longitudinal Stability

2.2.13.2.1 Test Conditions. Longitudinal stability shall be tested with the same weight as for lateral stability.

2.2.13.2.2 Rearward. The mower shall not tip over backward when tilted backward 30 degrees from horizontal.

2.2.13.2.3 Forward. The mower shall not tip over forward when tilted forward 40 degrees from horizontal.

2.2.13.3 Stability in Turns. Stability in turns shall be tested with the same weight as for longitudinal and lateral stability. The mower shall not tip over when, while proceeding in a straight line at maximum governed forward speed on level pavement, the mower is turned sharply and suddenly to the maximum angle of turn. This test shall be repeated for both right and left turns.

2.2.14 Wheel-Braking Means (Riding Mowers Only). Wheel-braking means shall be provided unless engine drag can be used to brake the mower.

2.2.15 Jackknifing (Riding Mowers Only). On sulky-type riding mowers, where the wheel drive is applied to the sulky wheels, adequate stops shall be provided to prevent jackknifing in any direction.

3. Reel Power Mowers

3.1 Definition. A reel mower is one that is supplied with several blades, each bent into a helix revolving about an axis, the blades cutting the grass by shearing between themselves and a cutting bar or bed knife.

3.2 Requirements

3.2.1 Wheel-Drive Controls. Wheel-drive controls shall provide positive disengagement and shall effectively prevent accidental engagement.

3.2.2 Guarding of Chains, Belts, and Gears. All moving chains, belts, and gears should be enclosed or adequately guarded to prevent personal injury.

3.2.3 Safety Instructions. The mower manufacturer shall supply with the mower the Safety Guide issued by or available from The Lawn Mower Institute, or other safety instructions which are substantially equivalent.

Appendix

(These are recommended practices only and are not mandatory. This Appendix is not a part of American Standard Safety Specifications for Power Lawn Mowers, B71.1-1960, but is included as an aid to the user.)

Suggestions For Users

A1. Mower Purchase

A1.1 Obtain assurance that the mower you buy conforms to the requirements in Sections 2.2 and 3.2 of American Standard B71.1-1960.

A1.2 The mower should be well balanced, maneuverable, easy to control, and suitable for you and your mowing requirements.

A1.3 The dealer should furnish you with detailed starting and operating instructions, including a demonstration.

A1.4 Mowers with recoil starters are easier to start than those with a separate rope.

A2. Training

A2.1 Regard your mower as a piece of power equipment, and teach this regard to all who operate the equipment.

A2.2 Never allow children or young teen-agers to operate a power mower.

A2.3 Be sure you know how to stop the mower and motor at a moment's notice.

A2.4 Instruct children to keep away from the area of operation of the mower at all times.

A3. Preparation

A3.1 Before starting operation, clear the entire lawn area of all debris that could catch on to or be thrown by the blade.

A3.2 Plan the cutting operation so it is not necessary to pull the mower rearward towards you, particularly on a downgrade.

A3.3 When you mow on rough terrain or in high grass or weeds, the blade should be set at the highest cutting point to minimize debris being ejected from the mower.

A3.4 Rotary mowers, in particular, should be restricted to use in clean areas where there is no debris that may be picked up and hurled out.

A3.5 Unless there is very good artificial light, mow only during the daylight.

A3.6 Do not operate power mowers in wet grass, which clogs the mower and increases the danger of your slipping and falling and possibly coming into contact with the blade.

A3.7 Mower guards should be in place before operation.

A3.8 Fill gasoline-driven mowers outdoors. Avoid spilling gasoline and *don't fill the tank* while the engine is running or while you are smoking.

A3.9 Check electrical power mowers to see that the cord is in good repair. Avoid mowing over wet terrain.

A3.10 Don't mow when barefoot or wearing open sandals. Provide some protection by means of long, heavy denim trousers and brogues. If you have safety shoes, wear them.

A4. Operation

A4.1 Give complete and undivided attention to the job at hand.

A4.2 Keep the cutting path in area of operation clear of all persons, particularly small children.

A4.3 Don't start the motor and blade until you are ready to start mowing. Stop the motor whenever you leave the mower.

A4.4 Don't overspeed the engine. Excessive cutting speed or tampering with the governor can be dangerous. Operate the engine at the slowest speed which will cut satisfactorily.

A4.5 Start the mower carefully. Stand firmly, with your feet away from the blade. Be sure the mower will not tip or roll during the starting operation.

A4.6 Stay clear of the front of self-propelled mowers during and after starting.

A4.7 If the mower handle has a safety latch to hold it in normal operating position, keep it engaged during the operation.

A4.8 Keep in step with the mower. If you lag behind or let it pull you, you will not be in full command of the machine. Do not run.

A4.9 Control the direction of the mower by hand pressure on the handle, not by foot pressure on the mower housing.

A4.10 When operating over uneven terrain and slopes, use extreme care and make sure of solid and firm footing at all times.

A4.11 Exercise special care when mowing around objects to prevent the blades from striking them and never deliberately mow over any object.

A4.12 Stop operation when another person approaches. Do not pass or stand on the grass-discharge side of the mower with the engine running.

A4.13 Prohibit others from riding with you on a riding mower.

A4.14 Riding-type mowers are like small tractors. It is possible to tip these mowers to either the back or side. Exercise extreme caution when using riding mowers on slopes or inclines.

A5. Maintenance and Storage

A5.1 Follow implicitly the manufacturer's recommendations for maintenance.

A5.2 Have a competent serviceman make a thorough inspection of the mower at least once a year.

A5.3 Never adjust the mower or change attachments until the engine has been turned off and the spark-plug wire disconnected. It is possible that the engine could start if the blade or cutter bar were turned while making an adjustment or repair.

A5.4 If carburetor adjustment is necessary, stand to one side and keep feet and hands in the clear while making adjustments.

A5.5 Keep motors free from accumulations of grass, leaves, or excessive grease. An accumulation of these combustible materials may result in a fire.

A5.6 Store power mowers in a cool, dry place when not in use.

A5.7 Store gasoline in a metal container approved by Underwriters' Laboratories or another recognized approving agency. Store the container in a cool, dry place, not in the house or near heating appliances.

A5.8 Keep the mower and fuel container in lock storage to prevent children from playing and tampering with them.

A5.9 Maximum mowing results and safety can only be expected if the mower is maintained and operated correctly.